

UTILITY PATENT APPLICATION TRANSMITTAL
(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No. : 35399/DBP/Y35
Inventor(s) : Bong-Woo Lee
Title : CATHODE RAY TUBE
Express Mail Label No. : EL368756025US

jc518 U.S. PTO
09/363121
07/28/99

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, D.C. 20231

Date: July 28, 1999

1. ☒ **FEE TRANSMITTAL FORM** *(Submit an original, and a duplicate for fee processing).*

2. **IF A CONTINUING APPLICATION**

☐ This application is a of patent application No. .

☐ This application claims priority pursuant to 35 U.S.C. §119(e) and 37 CFR §1.78(a)(4), to provisional Application No. .

3. **APPLICATION COMPRISED OF**

Specification

13 Specification, claims and Abstract (total pages)

Drawings

3 Sheets of drawing(s) (FIGS. 1 to 4)

Declaration and Power of Attorney

☒ Newly executed

☐ No executed declaration

☐ Copy from a prior application (37 CFR 1.63(d))(for continuation and divisional)

4. ☐ **Microfiche Computer Program** *(Appendix)*

5. ☐ **Nucleotide and/or Amino Acid Sequence Submission** *(if applicable, all necessary)*

☐ Computer Readable Copy

☐ Paper Copy (identical to computer copy)

☐ Statement verifying identity of above copies

6. **ALSO ENCLOSED ARE**

☐ Preliminary Amendment

☐ A Petition for Extension of Time for the parent application and the required fee are enclosed as separate papers

☐ Small Entity Statement(s)

☐ Statement filed in parent application, status still proper and desired

☐ Copy of Statement filed in provisional application, status still proper and desired

UTILITY PATENT APPLICATION TRANSMITTAL
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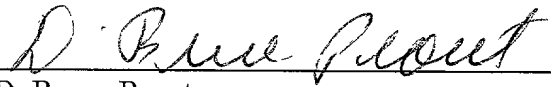
- ☒ An Assignment of the invention with the Recordation Cover Sheet and the recordation fee are enclosed as separate papers
- ☐ This application is owned by pursuant to an Assignment recorded at Reel , Frame
- ☐ Information Disclosure Statement (IDS)/PTO-1449
- ☐ Copies of IDS Citations
- ☒ Certified copy of Priority Document(s) (*if foreign priority is claimed*)
- ☐ English Translation Document (*if applicable*)
- ☒ Return Receipt Postcard (MPEP 503) (should be specifically itemized).
- ☐ Other

7. CORRESPONDENCE ADDRESS

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Respectfully submitted,

CHRISTIE, PARKER & HALE, LLP

By 
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626/795-9900

DBP/sfc

CATHODE RAY TUBE

CROSS REFERENCE TO RELATED APPLICATION

This application is based on application No. 98-50402 filed in the
5 Korean Industrial Property Office on November 24, 1998, the content of which
is incorporated hereinto by reference.

BACKGROUND OF THE INVENTION

(a) Field of the Invention

653440 "ref. 60
10 The present invention relates to a cathode ray tube, and more
particularly, to a cathode ray tube having a substantially rectangular cone
portion in which an inner graphite layer can be formed to an optimum thickness
on the rectangular cone portion such that high voltages are more uniformly
transmitted therethrough.

(b) Description of the Related Art

15 A cathode ray tube(CRT) is a device for displaying images on a screen
by emitting electron beams from an electron gun assembly and landing the
electron beams onto a phosphor screen. Conventional CRTs include a vacuum
envelop having a panel on which the phosphor screen is formed, a neck in
which the electron gun assembly is arranged, and a funnel formed between the
20 panel and the neck.

Immediately after the electron beams are emitted, they are horizontally

and vertically deflected by magnetic fields generated by a deflection yoke. Thus, the electron beams strike all pixels on the phosphor screen. The deflection yoke is mounted on an exterior of the funnel, i.e., on a cone portion of the funnel. The cone portion is formed contiguous to the neck. A cross-section of the cone portion typically reveals a circular form, and a cross-section of the deflection yoke reveals an inner circumference that is circular.

In such a CRT, the deflection efficiency of the deflection yoke is low since there is a considerable amount of space between deflection coils of the deflection yoke and the electron beams. To improve the deflection efficiency, power applied to the deflection yoke is increased. However, this increases the overall power consumption of the CRT and induces leakage of the magnetic fields.

To solve these problems, a cone portion having a cross-section that gradually changes from a circular form of the neck to a rectangular form of the panel has been developed. Because a shape at which the electron beams passing inside the cone portion is distributed substantially rectangular to correspond to the rectangular image produced on the panel, the cone portion is made into as close a shape to match the rectangular distribution shape of the electron beams as possible. Accordingly, an inner circumference of the deflection yoke mounted on the cone portion is also rectangular in shape.

Such a rectangular cone portion has various advantages. First, the electron beams can be prevented from striking the inner surface of the funnel since the rectangular shape provides space in the four diagonal portions on

which the electron beams are likely to strike. Second, the deflection efficiency can be increased by enabling the electron beams to come close to the deflection coils in the horizontal and vertical portions of the cone portion. Third, power consumption of the deflection yoke and magnetic field leakage generated by the deflection yoke can be reduced.

However, the rectangular cone portion is not rotationally symmetrical, and the four corners thereof are formed with sudden curvatures rather than the horizontal and vertical portions. As a result, when the inner graphite layer is applied on the inner surface of the funnel, it is not as uniformly applied on inside corners as it is on inside horizontal and vertical walls of the cone portion.

The inner graphite layer is a conductive layer which is disposed on the inner surface of the funnel at a predetermined thickness, and acts to transmit a voltage applied through an anode button to an accelerating electrode of the electron gun assembly and the panel. Thus, the electron beams are focused by a difference in potential between the voltages applied to the accelerating electrode and a focusing electrode of the electron gun, after which the electron beams are accelerated onto the phosphor screen by the high voltage on the panel.

Hence, it is important that the inner graphite layer uniformly transmits the high voltage so that the electron beams are exactly focused and accelerated. Accordingly, the inner graphite layer must have a constant resistance. Since the resistance of the inner graphite layer is directly related to its thickness (i.e., greater thickness results in smaller resistance), it is essential

that the inner graphite layer be evenly applied on the inner surface of the funnel.

However, because of the shape of the rectangular cone portion, the inner graphite layer can not be as evenly applied on the inside corners as on the inside horizontal and vertical walls of the cone portions. Consequently, a constant resistance over the entire inner graphite layer is not realized, thereby reducing the overall performance of the CRT.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a cathode ray tube having a rectangular cone portion in which an inner graphite layer is formed to an optimum thickness.

It is another object of the present invention to provide a cathode ray tube capable of uniformly transmitting a high voltage to an accelerating electrode of a electron gun assembly and a panel.

In order to achieve these objects, the CRT includes a rectangular panel, a cylindrical neck, a funnel formed between the panel and the neck and having a rectangular cone portion formed contiguous to the neck, an anode button to supply a high voltage in the funnel, and an inner graphite layer disposed on an inner surface of the funnel to form a path for the transmission of the high voltage. The inner graphite layer satisfies at least one of the following conditions:

$$0.9 \leq T_d / T_h \leq 1.36$$

$$0.9 \leq T_d / T_v \leq 1.36$$

where T_d is a thickness of the inner graphite layer disposed on inside corners of the cone portion, T_h is a thickness of the inner graphite layer disposed on inside horizontal walls of the cone portion, and T_v is a thickness of the inner graphite layer disposed on inside vertical walls of the cone portion.

When the inner graphite layer satisfies the above conditions, it can uniformly transmit the high voltage to the accelerating electrode of the electron gun assembly and the panel.

The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims as well as the appended drawings. It is also to be understood that both the foregoing general description and the following detailed description are not intended to limit the scope of this invention, many variations of which will be apparent to those with ordinary skill in the art. The disclosure of the specific embodiments are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate a particular embodiment of the invention and, together with the description, serve to explain the principles of the invention.

In the drawings:

Fig. 1 is a perspective view of a cathode ray tube according to a

preferred embodiment of the present invention;

Fig. 2 is a sectional view taken along line II-II of Fig.1;

Fig. 3 is a schematic view of an electron gun assembly shown in Fig. 1,
and a path of electron beams of the electron gun toward a panel;

Fig. 4 is a sectional view taken along line IV-IV of Fig. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Reference will now be made in detail to a preferred embodiment of the
present invention, an example of which is illustrated in the accompanying
drawings.

As shown in Figs. 1 and 2, a cathode ray tube according to a preferred
embodiment of the present invention includes a vacuum envelop 2 which is
formed with a substantially rectangular panel 4, a phosphor screen 6 being on
an inside surface of the rectangular panel 4; a small cylindrical neck 8 in which
an electron gun assembly 10 is arranged; and a funnel 12 formed between the
panel 4 and the neck 8. The funnel 12 includes a cone portion 12a formed
adjacent to the neck 8 and extending a predetermined distance in a direction
toward the panel 4.

The phosphor screen 6 includes three phosphor layers respectively
comprising red, green, and blue phosphors, the phosphors being formed in
predetermined dot or stripe-shape patterns. The phosphor layers are excited
and emit light by the striking of electron beams thereon. The electron beams
are generated by the electron gun assembly 10.

The cross-sectional shape of the funnel 12 progressively changes from a circular form of the neck 8 to a rectangular form of the panel 4. In particular, the cone portion 12a, on which a deflection yoke 14 is mounted, is designed to have a substantially rectangular section. Thus, the deflection yoke 14 is preferably designed having a substantially rectangular section corresponding to the rectangular section of the cone portion 12a. An anode button 16 is formed in the funnel 12 for the supply of a high voltage inside the funnel 12, and an inner graphite layer 18 is deposited over an entire inner surface of the funnel 12 to enable the high voltage supplied through the anode button 16 to be transmitted to the electron gun assembly 10.

As shown in Fig. 3, the electron gun assembly 10 for generating electron beams includes a triode 20 and a main focusing lens portion 28. The triode 20 is formed with a cathode 22 emitting heat electrons, and first and second grid electrodes 24 and 26 pre-focusing the electrons. The main focusing lens portion 28 comprises a focusing electrode 30 and an accelerating electrode 32 for respectively focusing and accelerating the electron beams onto the phosphor screen 6.

In the above electron gun assembly 10, the cathode 22, first and second grid electrodes 24 and 26, and focusing electrode 30 are respectively supplied required voltages through stem pins 34 (see Fig. 2) connected to an external circuit (not shown).

The main focusing lens portion 28 forms a main focusing lens by a difference in potential between voltages supplied to the focusing electrode 30

and the accelerating electrode 32. The focusing electrode 30 is supplied about 7-8 kV through the stem pins 34, while the accelerating electrode 32 is supplied a high voltage of about 25 kV through a bulb spacer 36 (see Fig. 2) which extends from the accelerating electrode 32 and contacts the inner graphite layer 18.

The inner graphite layer 18 transmits the high voltage to the accelerating electrode 32 of the electron gun assembly 10, and at the same time applies the high voltage to the panel 4 and a shadow mask 38, the shadow mask 38 dividing three electron beams to each phosphor layer. As a result, the electron beams of minus potential are accelerated onto the phosphor screen 6. In addition, the inner graphite layer 18 acts as a capacitor together with an outer graphite layer (not shown), which is deposited on an outer surface of the funnel 12, so as to prevent a ripple effect generated when alternating current is converted into direct current.

To perform such operations, it is necessary that the inner graphite layer 18 has a constant resistance so that it can uniformly transmit the high voltage. This constant resistance is realized by the inner graphite layer 18 being deposited at a uniform thickness over the entire inner surface of the funnel 12, including the cone portion 12a.

However, when a conductive graphite powder is applied and dried on the inner surface of the funnel 12, the resulting inner graphite layer 18 has a different thickness in corner portions of the cone portion 12a (i.e., in regions where the projection of diagonal lines of the phosphor screen 6 intersect the

inner surface of the cone portion 12a) than on inside surface of the four walls forming the cone portion 12a.

The CRT of the present invention provides an optimum thickness of the inner graphite layer 18 to all inside surface portions of the funnel 12 including the corners of the cone portion 12a to minimize variations in resistance.

Fig. 4 shows a sectional view taken along line IV-IV of Fig. 1. As shown in Fig. 4, the inner graphite layer 18 disposed on the inner surface of the cone portion 12a satisfies the following condition:

$$0.9 \leq T_d / T_h \leq 1.36$$

where T_d is a thickness of the inner graphite layer 18 disposed on the inside corners of the cone portion 12a, and T_h is a thickness of the inner graphite layer 18 disposed on horizontal (in the drawing) inside walls of the cone portion 12a.

Further, the inner graphite layer 18 satisfies the following condition:

$$0.9 \leq T_d / T_v \leq 1.36$$

where T_v is a thickness of the inner graphite layer 18 disposed on vertical (in the drawing) inside walls of the cone portion 12a.

The thickness T_h of the horizontal inside walls and the thickness T_v of vertical inside walls are substantially the same.

In the CRT structured as in the above, since the thickness ratio T_d / T_h or T_d / T_v is 0.9-1.36, the inner graphite layer 18 has suitable characteristics. That is, if the thickness ratio T_d / T_h or T_d / T_v becomes less than 0.9, the inner graphite layer 18 does not uniformly transmit the high voltage because of the

thin deposition on the corners relative to the inside wall. Further, if the thickness ratio T_d / T_h or T_d / T_v becomes more than 1.36, the inner graphite layer is thicker on the corners than on the inside walls such that the resistance of the inner graphite layer 18 increases, causing a reduction in the voltage level supplied to the panel 4 and the accelerating electrode 32.

The above conditions of the thickness ratio of the inner graphite layer are based on the results of several tests and simulations, which show the transmission efficiency of voltage is optimized when the thickness of the inner graphite layer meet the conditions.

By meeting the two thickness-related conditions with regard to the inner graphite layer, the CRT according to the present invention can uniformly transmit the high voltage, and minimize a drop in the voltage.

While the present invention has been described in detail with reference to the preferred embodiment, those skilled in the art will appreciate that various modifications and substitutions can be made thereto without departing from the spirit and scope of the present invention as set forth in the appended claims.

WHAT IS CLAIMED IS:

1. A cathode ray tube comprising:

a panel on which a phosphor screen is formed;

a cylindrical neck in which an electron gun assembly for generating
5 electron beams is arranged;

a funnel formed between the panel and the neck, and having a
rectangular cone portion formed contiguous to the neck;

an anode button provided on the funnel to supply a voltage in the
funnel; and

10 an inner graphite layer disposed on an inner surface of the funnel to
form a path for transmission of the voltage,

wherein the inner graphite layer satisfies the following condition:

$$0.9 \leq T_d / T_h \leq 1.36$$

15 where T_d is a thickness of the inner graphite layer on inside corners of
the cone portion, and T_h is a thickness of the inner graphite layer disposed on
inside horizontal walls of the cone portion.

2. A cathode ray tube comprising:

a panel on which a phosphor screen is formed;

20 a cylindrical neck in which an electron gun assembly for generating
electron beams is arranged;

a funnel formed between the panel and the neck, and having a

rectangular cone portion formed contiguous to the neck;

an anode button provided on the funnel to supply a voltage in the funnel; and

an inner graphite layer disposed on an inner surface of the funnel to form a path for transmission of the voltage,

wherein the inner graphite layer satisfies the following condition:

$$0.9 \leq T_d / T_v \leq 1.36$$

where T_d is a thickness of the inner graphite layer on inside corners of the cone portion, and T_v is a thickness of the inner graphite layer disposed on inside vertical walls of the cone portion.

ABSTRACT OF THE DISCLOSURE

A cathode ray tube includes a panel on which a phosphor screen is formed, a cylindrical neck in which an electron gun assembly is arranged, and a funnel formed between the panel and the neck. The funnel has a substantially rectangular cone portion on which a deflection yoke is mounted. An anode button is provided on the funnel to supply a high voltage in the funnel, and an inner graphite layer is disposed on an inner surface of the funnel to form a path for the transmission of the high voltage. The inner graphite layer satisfies at least one of the following conditions on an inner surface of the cone portion:

$$0.9 \leq T_d / T_h \leq 1.36$$

$$0.9 \leq T_d / T_v \leq 1.36$$

where T_d is a thickness of the inner graphite layer disposed on inside corners of the cone portion, T_h is a thickness of the inner graphite layer disposed on inside horizontal walls of the cone portion, and T_v is a thickness of the inner graphite layer disposed on inside vertical walls of the cone portion.

FIG. 1

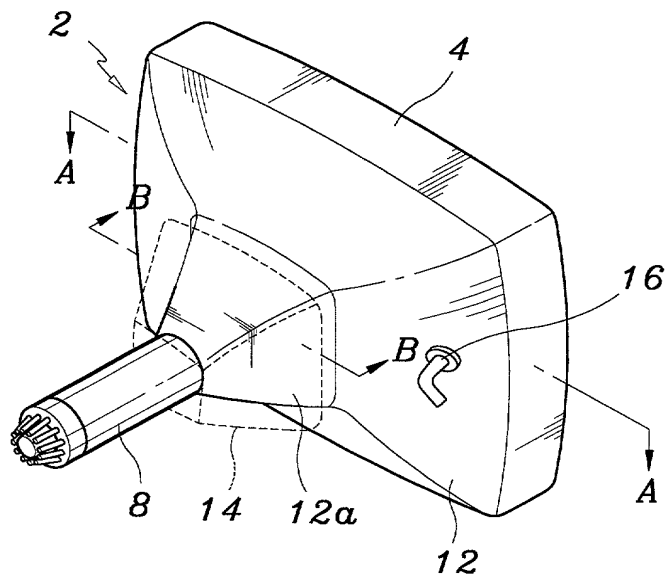


FIG. 2

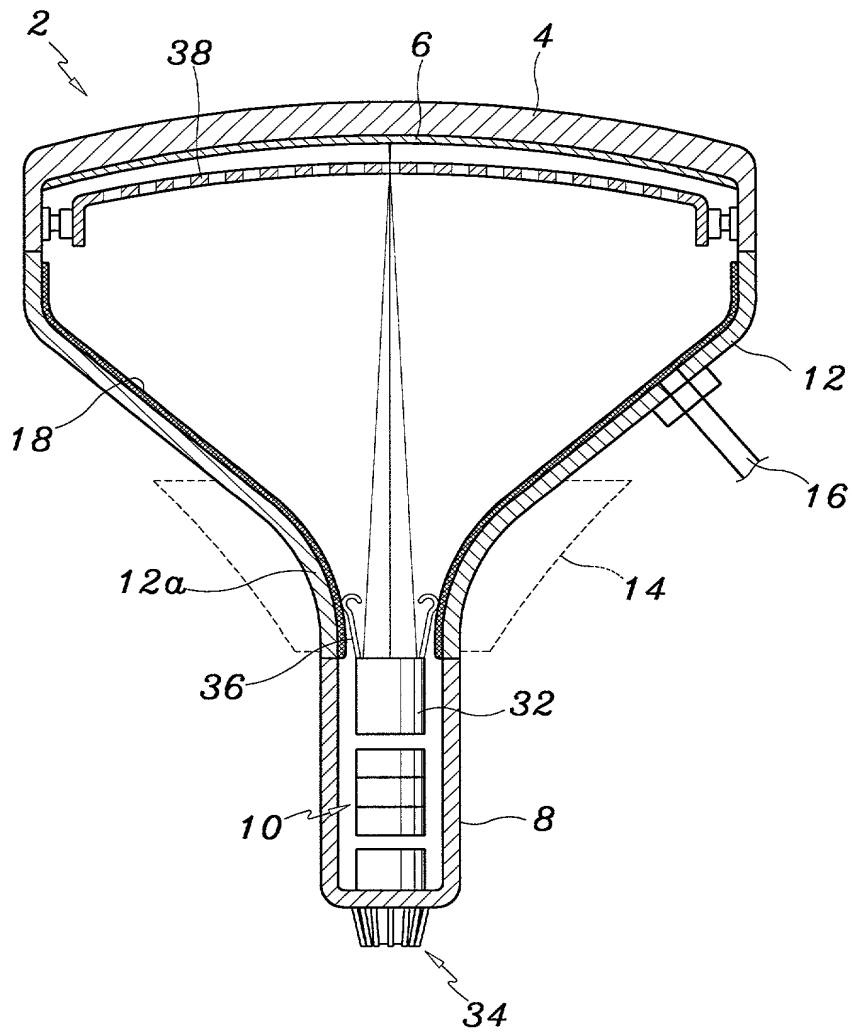


FIG. 3

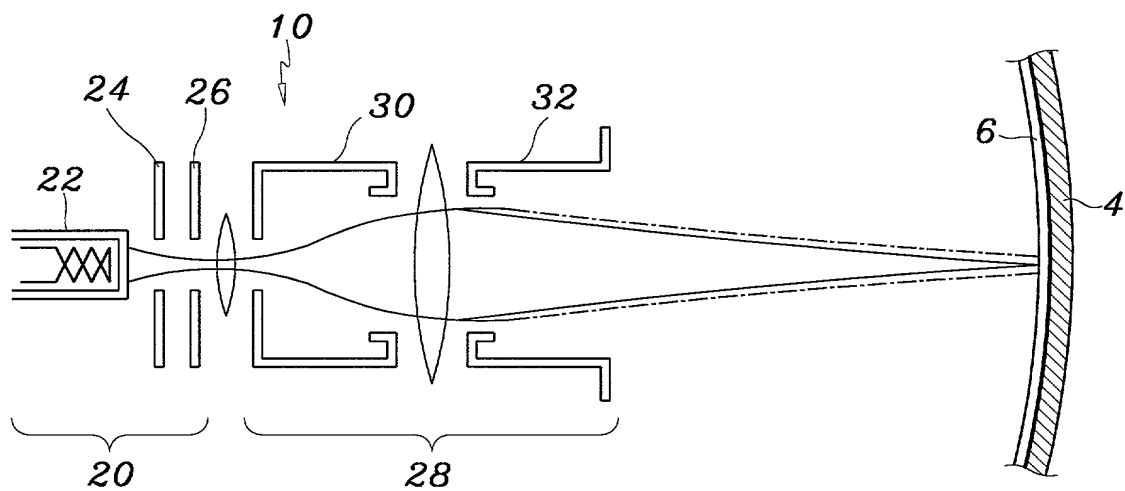
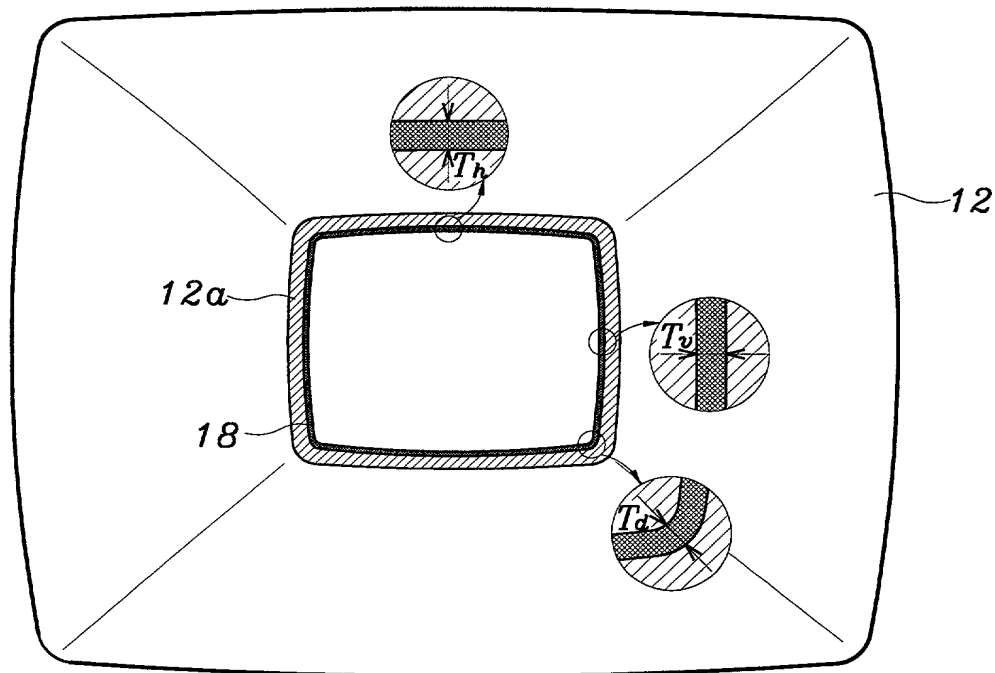


FIG. 4



Docket No.: 35399/DBP/Y35

Attorney : D. Bruce Prout, Esq.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **"CATHODE RAY TUBE"**, the specification of which is attached hereto unless the following is checked:

Was filed on _____ as United States Application Number or PCT International Application Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of the foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

| <u>Application Number</u> | <u>Country</u> | <u>Filing Date (day/month/year)</u> | <u>Priority Claimed</u> |
|---------------------------|----------------|-------------------------------------|-------------------------|
| 98-50402 | Korea | 24/11/1998 | Yes |

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below.

| <u>Application Number</u> | <u>Filing Date</u> |
|---------------------------|--------------------|
|---------------------------|--------------------|

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

| <u>Application Number</u> | <u>Filing Date</u> | <u>Patented/Pending/Abandoned</u> |
|---------------------------|--------------------|-----------------------------------|
|---------------------------|--------------------|-----------------------------------|

POWER OF ATTORNEY: I hereby appoint the following attorneys and agents of the law firm CHRISTIE, PARKER & HALE, LLP to prosecute this application and any international application under the Patent Cooperation Treaty based on it and to transact all business in the U.S. Patent and Trademark Office connected with either of them in accordance with instructions from the assignee of the entire interest in this application; or from the first or sole inventor named below in the event the application is not assigned; or from **YOU ME PATENT & LAW FIRM** in the event the power granted herein is for an application filed on behalf of a foreign attorney or agent.

**DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATIONS**

Docket No.: 35399/DBP/Y35

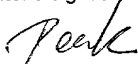
| | | | | | |
|------------------------|----------|------------------------|----------|---------------------|------------|
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The authority under this Power of Attorney of each person named above shall automatically terminate and be revoked upon such person ceasing to be a member or associate of or of counsel to that law firm.

D. Bruce Prout
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I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

| | | |
|--|---|---------|
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| Bong-Woo Lee |  | 99.6.24 |
| Residence and Post Office Address | Citizenship | |
| 575, Sin-dong, Paldal-ku, Suwon-si, Kyungki-do, Korea | Korea | |

| | | |
|--|----------------------|-------------|
| Full name of sole or second joint inventor | Inventor's signature | Date |
| Residence and Post Office Address | | Citizenship |